

Ultra-wide field angiography in the management of Eales disease

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Aims: This study aims to evaluate the use of ultra-wide field (UWF) angiography in patients with Eales disease (ED). **Settings and Design:** Prospective observational case series in tertiary eye care center. **Subjects and Methods:** This study involved 17 patients diagnosed with ED, who underwent UWF fluorescein angiography. The angiograms were analyzed to look for additional information as compared to Early Treatment Diabetic Retinopathy Study seven standard field. The impact of this information in the management of patients was analyzed. **Results:** 24 eyes of 17 patients with mean age of 26.3 years were diagnosed with ED and underwent UWF angiography. UWF fluorescein angiography was helpful in the documentation of peripheral retinal changes (in 67% of eyes), exact localization of capillary nonperfusion (CNP) (in 54% of eyes), and in determination of vascular involvement (in 21% of eyes). In 33% of eyes, immediate treatment plan changed because of changes picked up on UWF angiography. **Conclusions:** UWF angiography helped in the better documentation, exact quantification, and location of CNP areas and better determination of disease activity. UWF imaging may play an important part in the management of patients with ED.

Key words: Eales disease, fluorescein angiography, ultra-wide field imaging

Eales disease (ED) is a vaso-proliferative disorder of the retina characterized by peripheral retinal ischemia, neovascularization (NV) and recurrent vitreous hemorrhages.^[1] This is a result of inflammation of small peripheral retinal veins. ED is a diagnosis of exclusion and is particularly common in the Indian subcontinent with an estimated incidence of 1 in 200–250 ophthalmic patients.^[2] The treatment involves administration of peribulbar or systemic steroids in the stage of inflammation.^[3] One of the crucial steps of management in ED, once NV occurs, is to ablate the peripheral ischemic areas with laser photocoagulation so as to avoid complications such as recurrent vitreous hemorrhages and tractional retinal detachment.^[4] Fundus fluorescein angiography (FFA) plays a crucial role in detecting NV.

The conventional fundus cameras image 30–60° of the retina.^[5] The montage images can increase the amount of retinal area imaged.^[6] This may, however, result in significant time and manpower consumption and maybe a source of discomfort to the patient. Often it is impossible to image and document the anterior retinal changes occurring in ED.

Optos Tx200^[7] (Optos PLC, Dunfermline, Scotland, UK) is a confocal scanning laser ophthalmoscopy (cSLO) based technology, which images up to 200° of the retina and can capture color, fluorescein angiography, indocyanine green angiography, and autofluorescence images. The purpose of this study was to evaluate Optos ultra-wide field (UWF) angiography in the diagnosis and treatment of ED.

Subjects and Methods

It was a prospective observational study of 24 eyes of 17 consecutive patients with ED, who underwent FFA during

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the period June 2014 to April 2015 at our retina clinic. The study was conducted in accordance with Declaration of Helsinki.

Patients with peripheral retinal periphlebitis were labeled ED after exclusion of other common causes of retinal vasculitis such as tuberculosis, sarcoidosis, syphilis, and immunological disorders.

Fluorescein angiography was performed in all the patients using UWF imaging (Optos Tx200). After informed consent, 3 ml of 20% sodium fluorescein dye was injected and serial photographs taken. The color photographs were evaluated for additional information as compared to clinical examination. Both color photographs and fluorescein angiograms were also compared to what would be visible in approximately 75° of the field as seen in conventional Early Treatment Diabetic Retinopathy Study (ETDRS) seven standard field (7SF) photographs. Simultaneous conventional photography for comparison was not possible due to time and logistic constraints.

The primary outcome of this study was to assess the advantages of UWF angiography and overall change in management plan when compared with ETDRS 7SF. The follow-up period ranged from 12 to 40 weeks.

Results

Seventeen patients (24 eyes) were diagnosed as ED and enrolled in this study. The mean age of the patients was

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26.3 years. Fifteen out of 17 (88%) patients were males. The disease was bilateral in 7 out of 17 (41%) patients. The detailed clinical features as on slit lamp biomicroscopy and indirect ophthalmoscopy and UWF FFA features, management and potential advantages of UWF FFA were noted.

On clinical examination, 8 eyes had signs of active vasculitis while 16 eyes had healed vasculitis. Of these 16 eyes, 8 eyes had undergone previous laser photocoagulation. Three eyes had NV at disc or elsewhere while two eyes had fibrovascular proliferation and vitreous hemorrhage.

The UWF angiography showed ill-defined leakage from the vessels affected with active vasculitis. The peripheral vascular leakage (PVL) also signified active vasculitis. In the eyes with healed vasculitis, various changes such as capillary nonperfusion (CNP), microvascular abnormalities (MVA), peripheral collateral formation (PCF), microaneurysm formation, and vessel wall staining were observed. The NV was also noted on the disc or elsewhere in eyes with healed vasculitis.

The most common advantage of UWF angiography was documentation. We felt that in 16 of 24 (67%) eyes, the UWF FFA was helpful in documenting various features such as peripheral NV, CNP, and MVA [Fig. 1]. In 13 of 24 (54%) eyes, the UWF FFA was helpful in the exact localization of CNP areas especially those present in the retinal periphery [Fig. 2].

In 5 of 24 eyes (21%) of eyes, UWF FFA was helpful in determining the extent of disease and vascular involvement [Fig. 3]. This criterion was considered fulfilled only when the disparity between the areas involved was significantly different on clinical examination and UWF FFA.

Overall 8 of 24 (33%) eyes had the treatment plan changed because of the peripheral changes detected on UWF angiography. These included five eyes in which active vasculitis was picked up on UWF angiography only and treated with steroids.^[1] In two eyes, where clinically vasculitis appeared to be healed, PVL anterior to the equator marked the activity and prompted us to treat the patient with steroids. In one eye, another area of NV was detected which was treated with laser.

In one patient where clinical examination revealed a normal fellow eye, UWF FFA showed PCF and MVA in the retinal periphery indicating bilateral disease [Fig. 4].

The eyes detected to have active vasculitis (eight on clinical examination and five additional on UWF FFA) were treated with steroids. These were given orally in cases with bilateral disease or locally in the form posterior sub-tenon injection of Triamcinolone Acetonide to patients having unilateral disease. Of these, four patients received laser photocoagulation once the active inflammation resolved. Five eyes received laser photocoagulation targeted to the CNPs for NV. Five eyes with



Figure 1: Ultra-wide field pseudo-color image (a) of right eye showing active vasculitis with intra-retinal hemorrhages temporally (arrows). Ultra-wide field angiography (b) showed widespread active peripheral vasculitis with vascular leakage. Note unaffected vessels at the posterior pole apart from disc leakage, which indicates active vasculitis. There are areas of capillary nonperfusion and micro vascular abnormalities. Ultra-wide field pseudo-color image after steroid therapy (c) shows resolution of active vasculitis (blue arrow). Healed vasculitis is seen as sheathing (arrow heads)

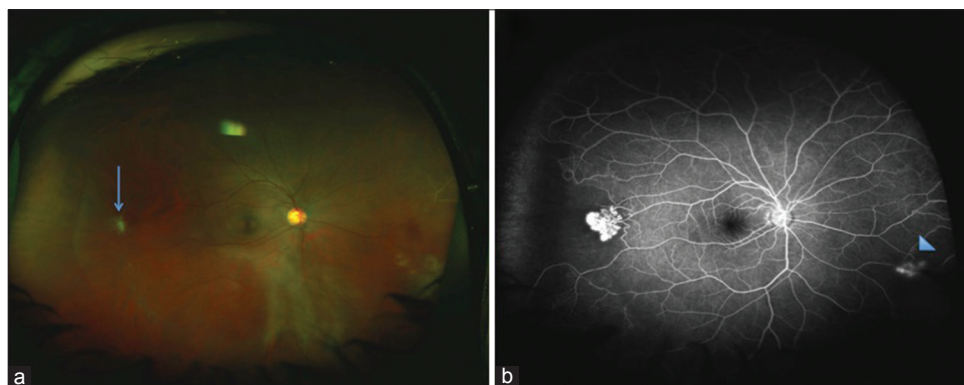


Figure 2: Ultra-wide field pseudo-color image of the right eye (a) of patient with Eales disease showing temporal sea fan neovascularization (blue arrow) and nasal area of sclerosed vessels. Ultra-wide field angiography (b) confirmed temporal sea fan neovascularization along with capillary nonperfusion areas anterior to it. In addition, area of healed vasculitis was confirmed and a neovascularization were picked in nasal periphery (arrow head), which were not seen clinically

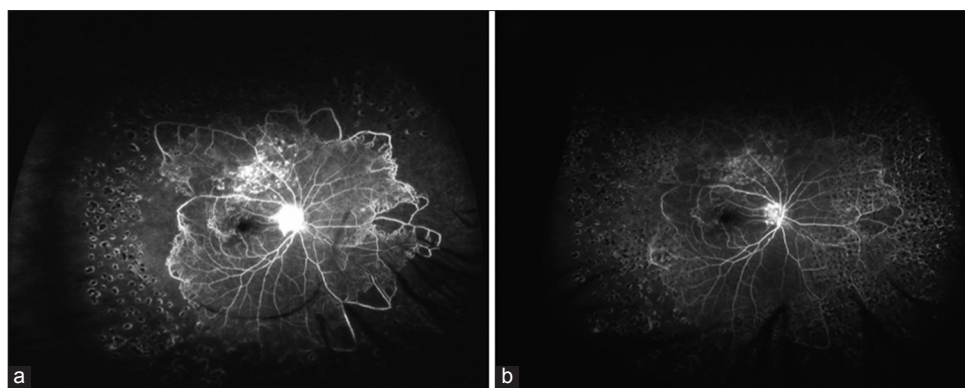


Figure 3: Ultra-wide field angiography of the right eye of a patient with Eales disease showing extensive vascular involvement, peripheral ischemia, and collateral formation (a). The laser photocoagulation has been done, but is inadequate leading to persistence of neovascularization of the disc. Targeted laser treatment resulted in prompt resolution of neovascularization of the disc (b)



Figure 4: Ultra-wide field angiography of fellow (left) eye of a patient with Eales disease. Though clinically the eye seemed uninvolved, on ultra-wide field angiography a small area of microvascular abnormalities and nonperfusion (blue arrow) is detected in far periphery indicating that the disease is bilateral

no active inflammation or NV were observed while one eye with FVP and vitreous hemorrhage underwent pars plana vitrectomy.

Discussion

Optos UWF imaging system has been recently introduced. It images up to 82% of the retinal area. It uses red and green light respectively for imaging choroid and retina providing us pseudo color UWF images of retina. In addition, it utilizes cSLO for acquiring high-resolution FFA images.

Leder *et al.*^[8] recently reported use of UWF retinal imaging in the management of noninfectious retinal vasculitis. They included 71 visits of 23 patients with retinal vasculitis secondary to panuveitis, sarcoidosis, intermediate uveitis, Behcet's disease, Wegner's disease and idiopathic vasculitis and concluded that UWF imaging can help in early detection of active vasculitis, which may help in better management and patient outcomes.

Mesquida *et al.*^[9] studied the use of UWF imaging in 38 eyes with active vasculitis because of Behcet's disease and concluded that this technology may be an important tool in the early

detection of disease activity and follow-up of these patients because of better delineation of nature and effects of vasculitis in the peripheral fundus.

UWF imaging has also been found to be useful in other vascular disorders affecting the peripheral retina. These include diabetic retinopathy by Wessel *et al.*,^[10] retinal venous occlusions by Prasad *et al.*,^[11] sickle cell retinopathy by Cho and Kiss^[12] noninfectious posterior uveitis by Campbell *et al.*^[13] and various pediatric conditions such as Coats disease and familial exudative vitreoretinopathy by Tsui *et al.*^[14] and Kang *et al.*^[15] However, the utility of UWF imaging has not been described before in ED.

Pathophysiologically ED passes through stages of inflammation, occlusion, NV and sequelae. FFA plays an important part in the assessment of all these stages and serves as an indispensable tool.

ED predominantly affects the peripheral retinal vasculature. While the disorders affecting the posterior retina can easily be documented and followed up with conventional photography, the peripheral retinal disorders are mainly followed up based on colored drawings, isolated conventional photographs of periphery or memory of the treating doctor. Documentation still remains a problem, which is especially important from research and medico-legal point of view. In our study, we found that UWF angiography resulted in better documentation in 67% of the eyes.

In ED sectoral laser to the nonperfused areas suffices in contrast to proliferative diabetic retinopathy where presence of any NV warrants pan retinal photocoagulation. It is, therefore, imperative to localize the CNP areas. UWF FFA facilitated in exact localization of peripheral nonperfusion (54%) in this study. Exact localization of CNP areas helped in targeted laser photocoagulation. The quantification of nonperfusion area is however not very reliable on wide field images as it projects three-dimensional retina onto the two-dimensional image. In one-third of eyes, the immediate management plan was changed because of the findings picked up on UWF angiography. UWF FFA was also useful in determination of extent of disease and vascular involvement (21%).

To summarize, UWF imaging is a very helpful tool in the management of a patient with ED. Longitudinal studies are

required to find out the impact of this technology on patient outcomes.

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Conflicts of interest

There are no conflicts of interest.

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